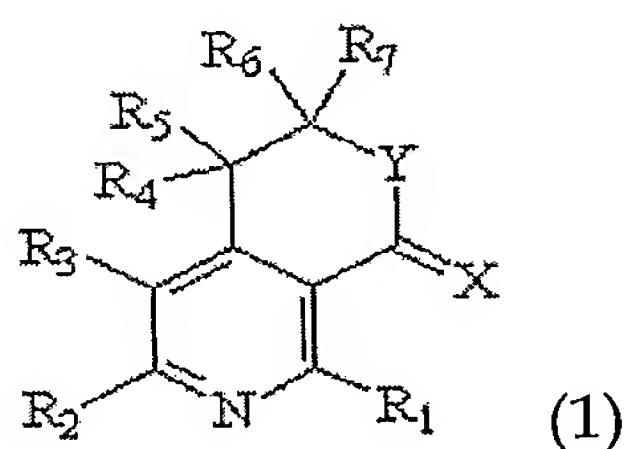


What is claimed is:

1. A compound or pharmaceutically acceptable salt of the following formula 1,



wherein  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$ ,  $R_5$ ,  $R_6$  and  $R_7$  are independently selected from the group consisting of a hydrogen atom, a halo, a cyano, a nitro, an acyl, a hydroxy, an amino, a  $C_1$ - $C_6$  low alkyl, a  $C_2$ - $C_6$  low alkenyl, a  $C_1$ - $C_6$  low alkoxy, a  $C_1$ - $C_6$  alkylthio, a  $C_1$ - $C_{10}$  alkylamino, a  $C_4$ - $C_9$  cycloalkylamino, a  $C_4$ - $C_9$  heterocycloalkylamino, a  $C_1$ - $C_{10}$  aralkylamino, an arylamino, an acylamino, a saturated heterocyclic, an acyloxy, a  $C_1$ - $C_6$  alkylsulfinyl, a  $C_1$ - $C_6$  alkylsulfonyl, a  $C_1$ - $C_6$  alkylsulfonylamino, an arylsulfinyl, an arylsulfonyl, an arylsulfonylamino, an aryl, a heteroaryl, a  $C_1$ - $C_{10}$  aralkyl, a  $C_1$ - $C_{10}$  heteroaralkyl, an aryloxy and a heteroaryloxy group; or  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$ ,  $R_5$ ,  $R_6$  and  $R_7$  independently form a ring by binding with a neighboring substitution group;

15 X is an oxygen or sulfur atom;

Y is an oxygen atom or N- $R_8$ , wherein  $R_8$  is selected from the group consisting of a hydrogen atom, a  $C_1$ - $C_6$  low alkyl, an acyl, an aryl, a heteroaryl, a  $C_1$ - $C_{10}$  aralkyl and a  $C_1$ - $C_{10}$  heteroaralkyl group; or forms a ring by binding with a neighboring substitution group of  $R_6$  or  $R_7$ ;

20 said aryl group is selected from a phenyl, a naphthyl and a fused phenyl group;

said heteroaryl and saturated heterocyclic groups are a heterocyclic ring with

a pentagonal or hexagonal shape having 1 to 3 heteroatoms selected from an oxygen, a nitrogen, and a sulfur atom; or a fused heterocyclic ring; and

said aryl and heteroaryl groups are such that 1 to 4 substitution groups selected from the group consisting of a halo, a hydroxy, a C<sub>1</sub>-C<sub>6</sub> low alkyl, a C<sub>1</sub>-C<sub>6</sub> low alkoxy, an amino, a cyano, a nitro, a carbonyl and a carboxyl group are substituted.

2. In claim 1, said X and Y are independently an oxygen atom.

10 3. In claim 1, said R<sub>1</sub>, R<sub>2</sub> and R<sub>3</sub> are independently selected from the group consisting of a hydrogen atom, a halo, a hydroxy, a C<sub>1</sub>-C<sub>6</sub> low alkyl, a C<sub>2</sub>-C<sub>6</sub> low alkenyl, a C<sub>1</sub>-C<sub>6</sub> low alkoxy, an aryloxy, an amino, a C<sub>1</sub>-C<sub>6</sub> alkylamino, a C<sub>1</sub>-C<sub>10</sub> aralkylamino, an arylamino, an acylamino, a saturated heterocyclic, an aryl, a heteroaryl, and a C<sub>1</sub>-C<sub>10</sub> heteroaralkyl group; or neighboring R<sub>2</sub> and R<sub>3</sub> form a ring by binding with each other;

15 said R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub> and R<sub>7</sub> are independently selected from the group consisting of a hydrogen atom, a C<sub>1</sub>-C<sub>6</sub> low alkyl and an aryl group; or R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub> and R<sub>7</sub> independently form a ring by binding with a neighboring substitution group;

X is an oxygen or sulfur atom;

20 Y is an oxygen atom or N-R<sub>8</sub>, wherein R<sub>8</sub> is selected from the group consisting of a hydrogen atom, a C<sub>1</sub>-C<sub>6</sub> low alkyl, an aryl, and a C<sub>1</sub>-C<sub>10</sub> aralkyl group;

said aryl group is a phenyl group;

said heteroaryl and saturated heterocyclic groups are selected from furan, thiophene, pyridine, piperidine, piperazine, morpholine, pyrrolidine and

benzodioxol; and

said aryl and heteroaryl groups are such that 1 to 4 substitution groups selected from the group consisting of a halo, a hydroxy, a C<sub>1</sub>-C<sub>6</sub> low alkyl, a C<sub>1</sub>-C<sub>6</sub> low alkoxy, an amino, a cyano, a nitro, a carbonyl and a carboxyl group are substituted.

4. In claim 1, said compound of formula 1 is selected from the group consisting of

3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

5-vinyl-3,4-dihydro-pyrano [3,4-c]pyridine-1-on,

6,8-dichloro-3,4-dihydro-pyrano [3,4-c]pyridine-1-on,

6,8-dihydroxy-3,4-dihydro-pyrano [3,4-c]pyridine-1-on,

8-hydroxy-6-methyl-3,4-dihydro-pyrano [3,4-c]pyridine-1-on,

8-chloro-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-1-oxo-3,4-dihydro-1*H*-pyrano[3,4-c]pyridine-8-yl acetic ester,

8-methoxy-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6,8-dimethyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-8-furan-2-yl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-8-thiophene-2-yl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-8-pyridine-2-yl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-(4-fluoro-phenyl)-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-(4-chloro-phenyl)-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-8-piperidine-1-yl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-8-morpholine-4-yl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-8-(4-methyl-piperazine-1-yl)-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-8-(4-pyrimidine-2-yl-piperazine-1-yl)-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

5 8-(4-fluoro-phenylamino)-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-(4-chloro-phenylamino)-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-(4-trifluoromethyl-phenylamino)-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-8-*p*-tolylamino-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

10 6-methyl-8-phenylamino-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-8-phenethylamino-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-[(benzo[1,3]dioxol-5-ylmethyl)-amino]-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-8-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

15 6-methyl-8-phenoxy-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-benzylamino-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-(4-methoxy-benzylamino)-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-amino-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

20 8-acetamido-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-benzamido-6-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-hydroxy-6-methyl-5-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-chloro-6-methyl-5-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-methyl-5-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
8-hydroxy-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
8-chloro-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
8-methyl-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
5 1-oxo-6-phenyl-3,4-dihydro-1*H*-pyrano[3,4-c]pyridine-8-yl acetic ester,  
8-methoxy-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
8-methylamino-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
8-dimethylamino-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
6-phenyl-8-piperidine-1-yl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
10 8-morpholine-4-yl-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
6-phenyl-8-pyrrolidine-1-yl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
8-(4-fluoro-phenylamino)-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
8-(4-methoxy-benzylamino)-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-  
on,,  
15 8-amino-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
8-acetamido-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
8-benzamido-6-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
6-hydroxy-8-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
6-chloro-8-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
20 8-methyl-6-(thiophene-2-yl)-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
6-(furan-2-yl)-8-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,  
6-(benzo[d][1,3]dioxol-6-yl)-8-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-  
on,  
6-(4-(dimethylamino)phenyl)-8-methyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-

on,

8-hydroxy-6-propyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-chloro-6-propyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

8-propyl-6-chloro-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

5 8-morpholine-4-yl-6-propyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

1-oxo-6-propyl-3,4-dihydro-1*H*-pyrano[3,4-c]pyridine-8-yl acetic ester

8-(4-methoxy-benzylamino)-6-propyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-

on,

8-amino-6-propyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

10 *N*-(1-oxo-6-propyl-3,4-dihydro-1*H*-pyrano[3,4-c]pyridine-8-yl)-acetamide,

3,4-dihydro-2-oxa-aza-phenanthrene-1-on,

3,4-dihydro-pyrano[3,4-c]pyridine-1-thione,

2-(4-methoxy-benzyl)-3,4-dihydro-2*H*-[2,7]naphthyridine-1-on,

3,4-dihydro-2*H*-[2,7]naphthyridine-1-on,

15 2-benzyl-3,4-dihydro-2*H*-[2,7]naphthyridine-1-on,

3-phenyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

3-phenyl-3,4-dihydro-2*H*-[2,7]naphthyridine-1-on,

8-methyl-6-phenyl-3,4-dihydro-2*H*-[2,7]naphthyridine-1-on,

2,8-dimethyl-6-phenyl-3,4-dihydro-2*H*-[2,7]naphthyridine-1-on,

20 2-benzyl-8-methyl-6-phenyl-3,4-dihydro-2*H*-[2,7]naphthyridine-1-on,

6-cyclohexyl-8-hydroxy-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

6-cyclohexyl-1-oxo-3,4-dihydro-1*H*-pyrano[3,4-c]pyridine-8-yl acetic acid

methyl ester,

8-chloro-6-cyclohexyl-3,4-dihydro-pyrano[3,4-c]pyridine-1-on,

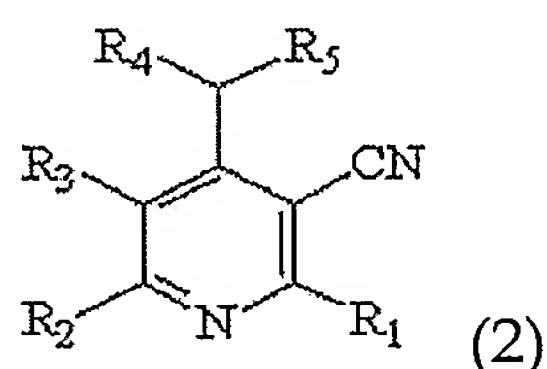
6-cyclohexyl-8-piperidine-1-yl-3,4-dihydro-pyrano[3,4-*c*]pyridine-1-on,  
 6-cyclohexyl-8-(4-methoxy-benzylamino)-3,4-dihydro-pyrano[3,4-*c*]pyridine-  
 1-on,  
 8-amino-6-cyclohexyl-3,4-dihydro-pyrano[3,4-*c*]pyridine-1-on,  
 8-hydroxy-6-isopropyl-3,4-dihydro-pyrano[3,4-*c*]pyridine-1-on,  
 6-isopropyl-1-oxo-3,4-dihydro-1*H*-pyrano[3,4-*c*]pyridine-8-yl acetic acid  
 methyl ester,  
 8-chloro-6-isopropyl-3,4-dihydro-pyrano[3,4-*c*]pyridine-1-on,  
 6-isopropyl-8-(4-methoxy-benzylamino)-3,4-dihydro-pyrano[3,4-*c*]pyridine-  
 1-on; and  
 their pharmaceutically acceptable salts.

5. A method for preparing a compound of the following formula 1 comprising:

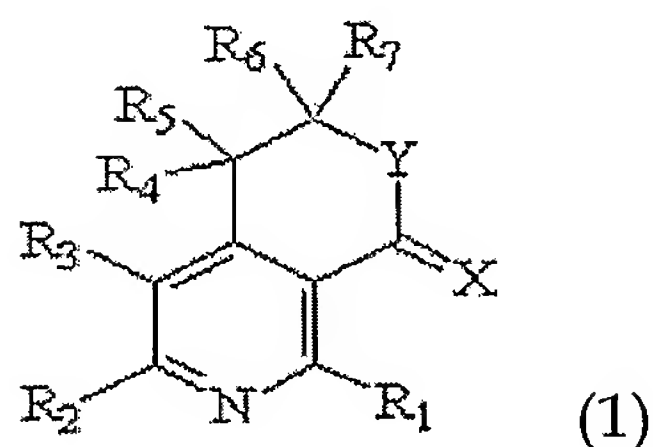
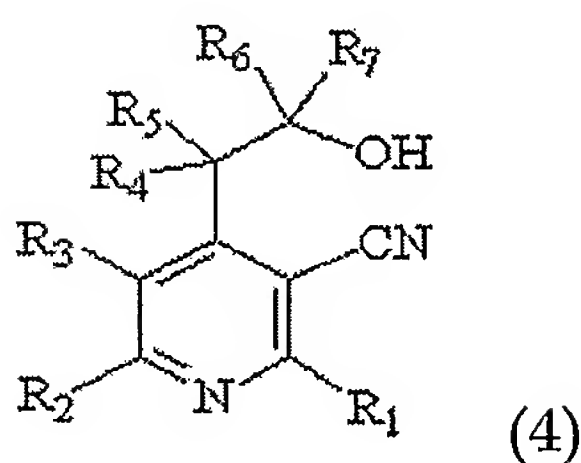
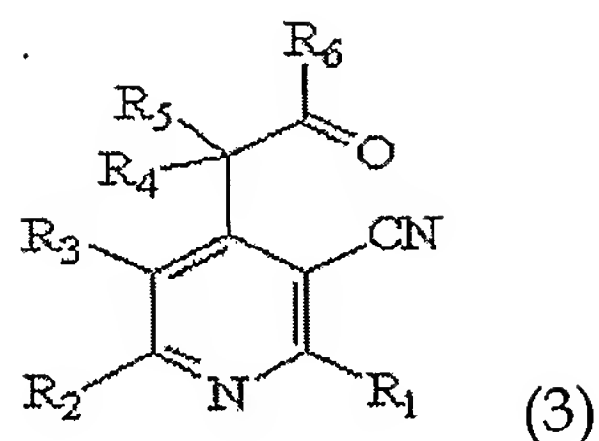
(a) reacting a compound of the following formula 2 with an alkylester  
 compound containing R<sub>6</sub> in the presence of a base to obtain a compound of the  
 following formula 3;

(b) reacting said compound of the following formula 3 with a reducing agent  
 or a metal reagent containing R<sub>7</sub> at 0 °C or room temperature to obtain an alcohol  
 compound of the following formula 4; and

(c) performing a cyclization of said alcohol compound of the following  
 formula 4 to obtain a compound of the following formula 1,







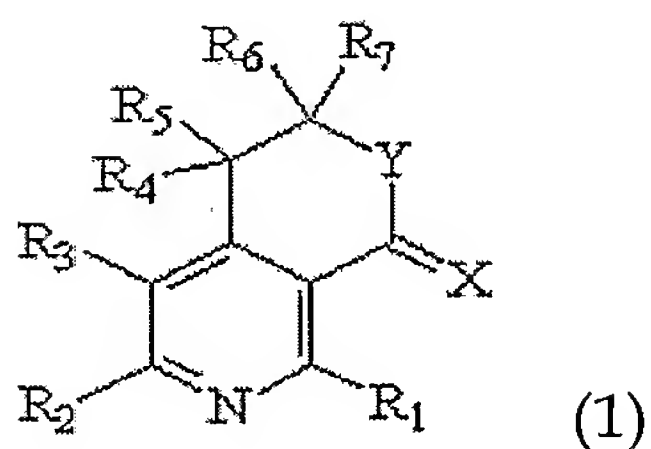
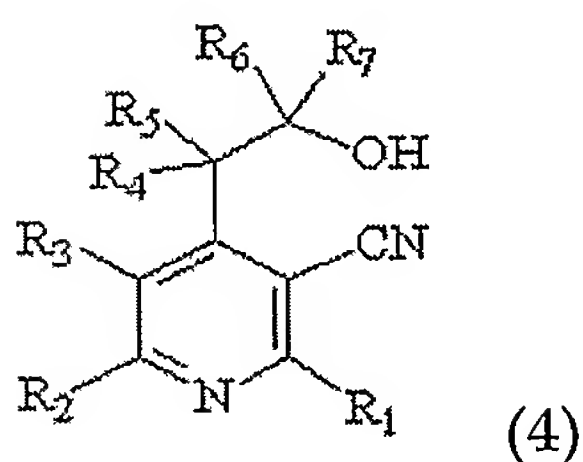
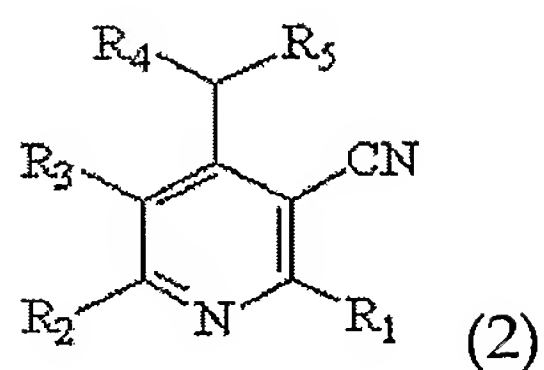
wherein  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$ ,  $R_5$ ,  $R_6$ , and  $R_7$  are the same as defined in claim 1, and X and Y individually represent an oxygen atom.

6. A method for preparing a compound of the following formula 1 comprising:

(a) reacting a compound of the following formula 2 with an alkylcarbonyl compound represented by  $R_6COR_7$  in the presence of a base to obtain a compound of the following formula 4; and

(b) performing a cyclization of said alcohol compound of the following formula 4 to obtain a compound of the following formula 1,





wherein  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$ ,  $R_5$ ,  $R_6$ , and  $R_7$  are the same as defined in claim 1, and X and Y individually represent an oxygen atom.

7. In claim 5, said alkylester compound containing  $R_6$  is represented by  $R_6\text{COOCH}_3$ .

8. In claim 5, said metal reagent containing  $R_7$  is a Grignard reagent of  $R_7\text{M}$ , wherein M is an alkali metal, or  $R_7\text{MgX}^1$ , wherein X is a halogen atom).

9. In claim 5 or claim 6, said base is selected from the group consisting of lithium bis(trimethylsilyl)amide, potassium bis(trimethylsilyl)amide, lithium diisopropylamide, sodium hydride, potassium hydride and lithium hydride.

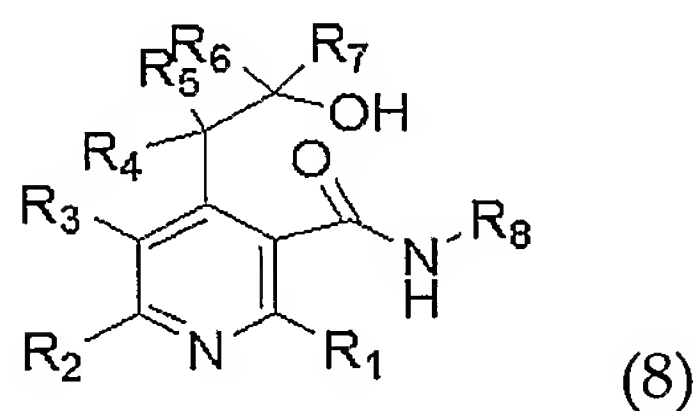
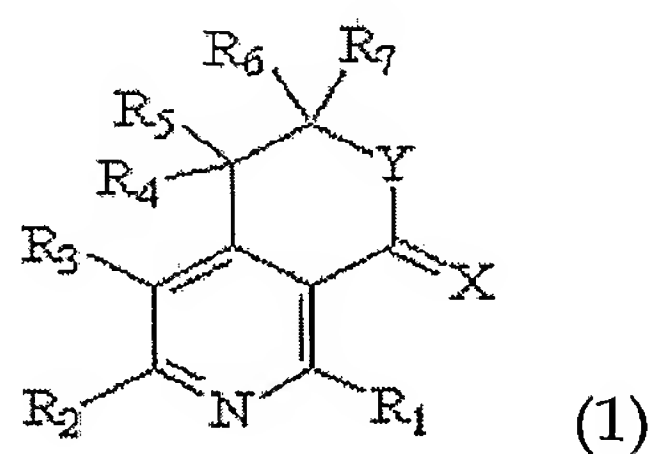
10. In claim 5 or claim 6, said cyclization is performed by using a strong acid reagent of conc. HCl.

11. A method for preparing a compound of the following formula 1 comprising:

5 (a) reacting a compound of the following formula 1, wherein X and Y are individually an oxygen atom, with an amine compound represented by  $R_8NH_2$  to obtain a compound of the following formula 8; and

(b) performing a cyclization of said compound of the following formula 8 to obtain a compound of the following formula 1, wherein X is an oxygen atom and Y is N- $R_8$ ,

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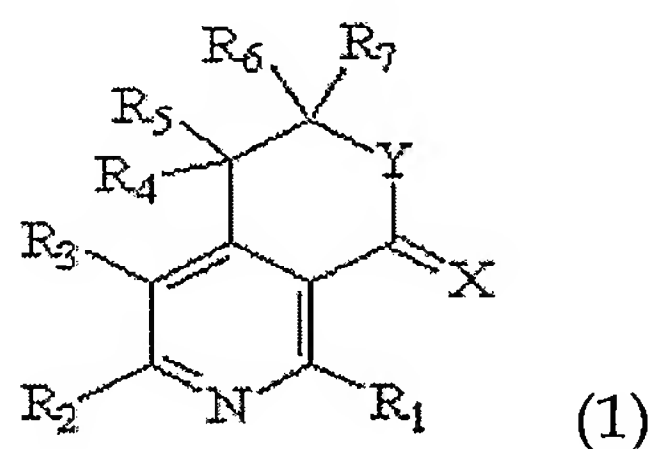


15 wherein  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$ ,  $R_5$ ,  $R_6$ ,  $R_7$ ,  $R_8$ , X and Y are the same as defined in claim 1.

12. In claim 11, said cyclization is performed by using diethyl azodicarboxylate and triphenylphosphine.

20 13. A pharmaceutical composition having an inhibitory effect on the production of

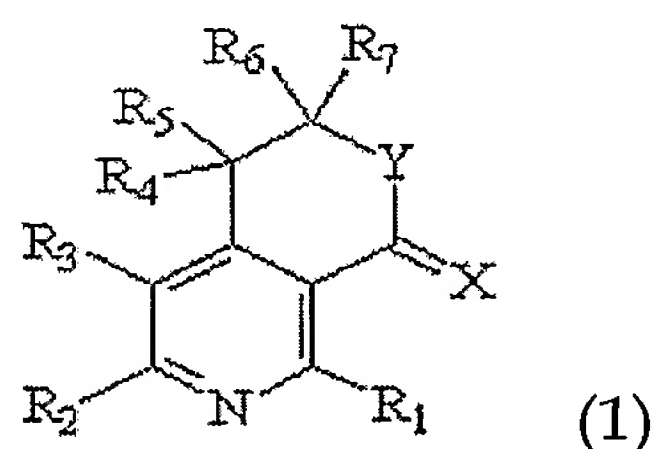
cytokines wherein said composition comprises a compound of the following formula 1 or its pharmaceutically acceptable salt,



5 wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub>, R<sub>7</sub>, X and Y are the same as defined in claim 1.

14. In claim 13, said cytokine is TNF- $\alpha$ .

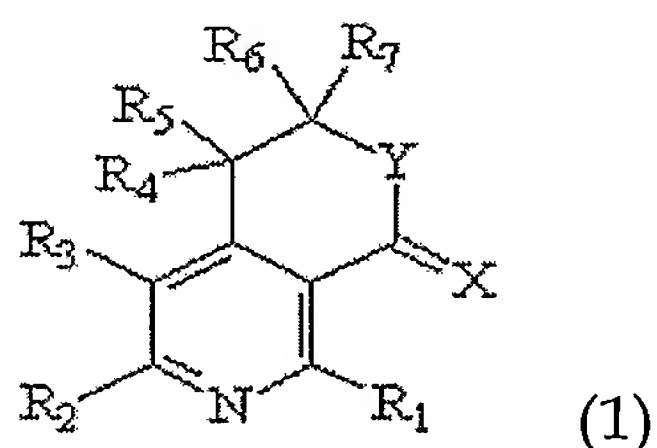
15. A therapeutic agent comprising a compound of the following formula 1 or its  
10 pharmaceutically acceptable salt effective in treating inflammatory diseases,



wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub>, R<sub>7</sub>, X and Y are the same as defined in claim 1.

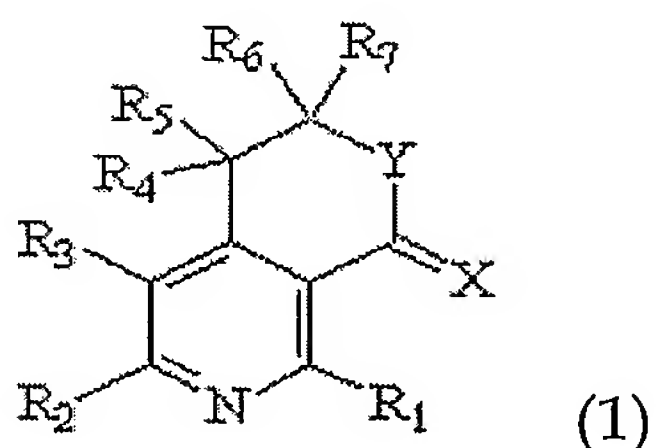
15 16. In claim 15, said inflammatory diseases are selected from the group consisting of rheumatic arthritis, multiple sclerosis, Crohn' disease, ulcerative colitis, graft-versus-host disease, systnemic erythematosus lupus, toxic shock syndrome, osteoarthritis and insulin-dependent diabetes.

17. A therapeutic agent having an anti-inflammatory and analgesic effect comprising a compound of the following formula 1 or its pharmaceutically acceptable salt,



5 wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub>, R<sub>7</sub>, X and Y are the same as defined in claim 1.

18. A therapeutic agent for treating immune-related diseases comprising a compound of the following formula 1 or its pharmaceutically acceptable salt,



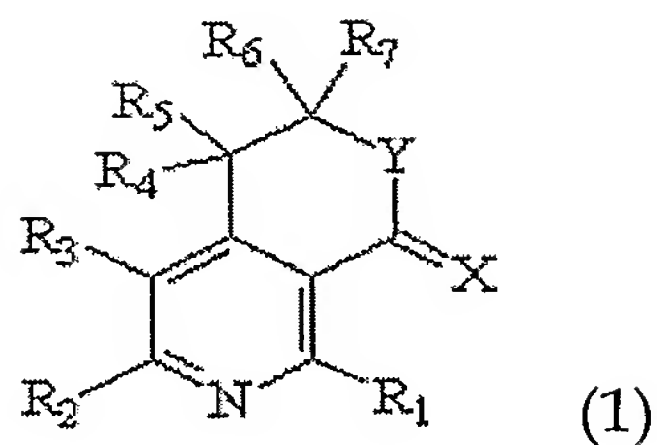
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wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub>, R<sub>7</sub>, X and Y are the same as defined in claim 1.

19. In claim 18, said immune-related diseases are selected from the group consisting of glomerulonephritis, dermatitis, asthma, stroke, cardiac infarction, acute respiratory distress syndrome, postinjury multiple organ failure, purulent meningitis, necrotizing enterocolitis, parahemodialysis syndrome, septic shock, and post-menopausal osteoporosis.

20. A therapeutic agent for treating chronic inflammatory diseases comprising a compound of the following formula 1 or its pharmaceutically acceptable salt,

20



wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub>, R<sub>7</sub>, X and Y are the same as defined in claim 1.

- 5     21. In claim 20, said chronic inflammatory diseases are psoriatic arthritis, psoriasis, ankylosing spondylitis, adult-onset Still's disease, polymyositis, dermatomyositis, or vasculitis such as Behcet disease and Wegener's granulomatosis.

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